Recent activities on the 137 kHz band in VK1 and VK2

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Australian amateurs were granted a frequency allocation between 135.7 and 137.8 kHz in January 2009. This band offers a number of interesting challenges:

- As the wavelength is approximately 2200 m, any antenna that the average amateur can erect is very inefficient, resulting in very low radiated power.
- Most commercial equipment has very limited capability at LF, so much of the equipment used has to be home built.
- The band is very noisy due to interference from switch-mode power supplies, compact fluorescent lights and many other devices.
- For anything beyond local contacts, the operating modes and procedures are unlike that used on most of the other amateur bands.

However, despite these factors, or perhaps because of them, there is activity taking place in a number of locations at present.

The purpose of this article is to inform other interested people and to increase activity in this fascinating area of radio communications.

Arranging LF activities

Since approximately November, 2009 there have been fairly regular test transmissions from VK2AVQ and VK2AWD in Sydney and VK1SV and VK1DSH in Canberra, with a number of listeners in New Zealand also observing and hoping to receive signals. Due to the presently small number of people involved, these tests are usually arranged in advance via the Low Frequency Experimenters (lofexp) mailing list which is run by Steve VK2XV as part of his *DownUnder LF Experimenters' Group* website (http://au.groups.yahoo.com/group/lofexp/).

Transmission times, frequencies and modes are posted on the mailing list, as are signal reports which are usually posted shortly after the test transmission is complete. Aside from the advertised tests there are ad-hoc transmissions in the usual amateur way, but given the few likely listeners (at present) these tests generally go unreported.

Communication Modes

Due to high levels of noise (natural and man-made) and weak signal strengths for all but local contacts, long distance contacts use various types of slow, or very slow speed Morse code, either as conventional On-Off Keying, or some variation of Frequency Shift Keying (dots and dashes sent as different frequencies).

These modes are generically referred to as QRSS with a descriptor for the length of the signalling element (a 'dot') e.g. QRSS120

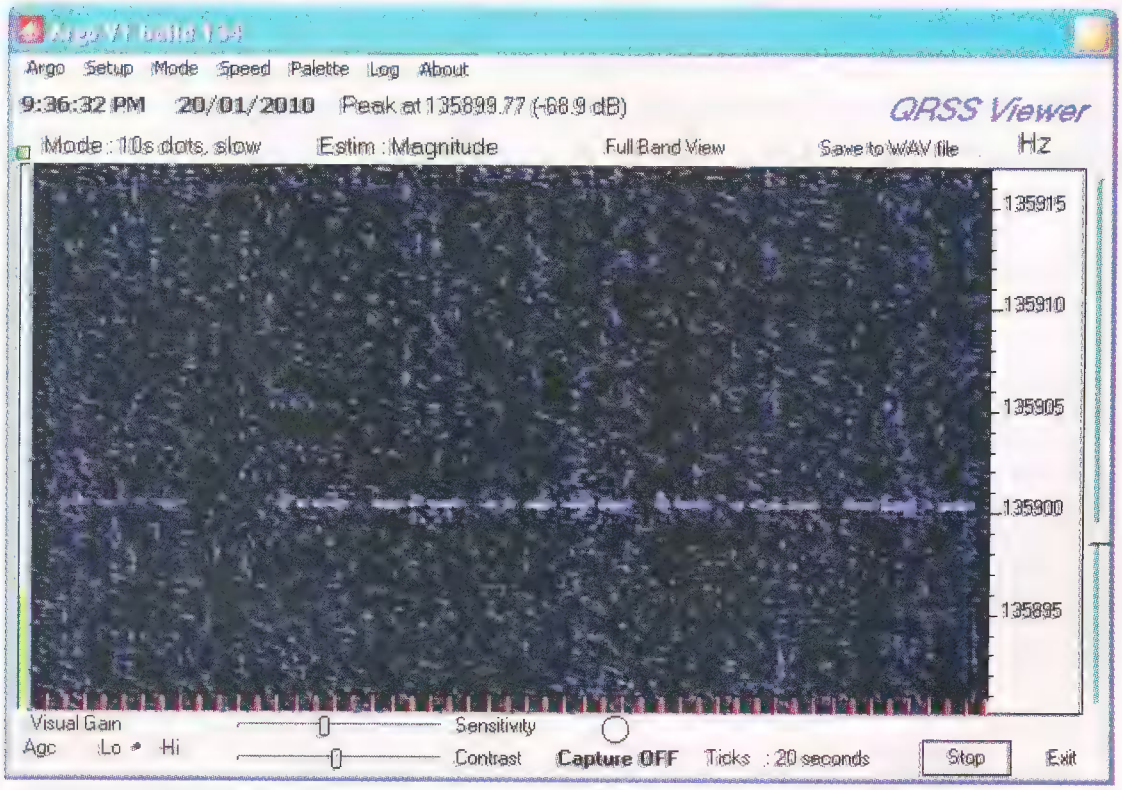

Figure 1: A QRSS CW signal received in Canberra from VK2AVQ using ARGO. The user has the option of calibrating ARGO so that it shows the actual transmit/receive frequency or the audio beat frequency.

translates to very slow speed CW using 120 second dot lengths.

The implication of the slow speed is that the receiver bandwidth can be very narrow (to maximise received signal to noise ratio) and that the message takes a long time to transmit.

Recent work by ZL1BPU to increase the amount of text sent in a given time has resulted in the introduction of CASTLE mode, where dots and dashes are sent at slightly different frequencies depending on their location within the actual code character. This improves signalling efficiency by approximately three times. See http://www.qsl.net/zl1bpu/MICRO/EXCITER/castle.htm for more details.

In all cases, a QRSS contact uses a computer to acquire and display the spectra of the received signal and the operator decodes the message by looking at the display. A typical example is shown in Figure 1.

The free available program called ARGO is generally used, although other packages exist. ARGO can be downloaded from the website of its author I2PHD: http://www.weaksignals.com/

Equipment used

A wide range of equipment can be used for LF activity, either all home made or a combination of home made converters and commercial equipment. A typical setup uses separate aerials for receive and transmit; receive aerials are usually either loops or active whips depending on the local electrical environment.

Transmit aerials are generally an 'inverted L' or 'T' type antenna at a height of about 10 m (or higher if possible) and as long as possible.

Drew Diamond VK3XU has published a number of construction articles in *AR* magazine for 137 kHz equipment and the RSGB book *LF today* (available through the WIA bookshop) contains a wealth of construction and operational information.

Results so far

Recently there have been a number of transmission tests which are very useful for determining and developing the capability of individual LF stations.

Signals have been successfully received in Canberra from Sydney stations and vice-versa.

Two-way QSOs have occurred between VK1SV and VK1DSH, between VK2AWD and VK1DSH and between VK2AVQ, VK2AWD and VK2XV. Various modes have been used, including standard CW.

On 21 March 2010 signals from VK1DSH in Canberra were received by stations in New Zealand. This is believed to be the first time that a transmission from VK1 on the 137 kHz LF band has been heard across the Tasman.

The transmission took place using QRSS120 CASTLE mode and Figure 2 shows the signal received by ZL2CA.

Conclusion

This short article was written to highlight the current 137 kHz activity known to the author in the VK1 and VK2 regions.

The 137 kHz band offers many interesting challenges and the opportunity to explore a part of the radio spectrum that has remained 'off limits' to amateurs since (more-or-less) the beginning of the radio age.

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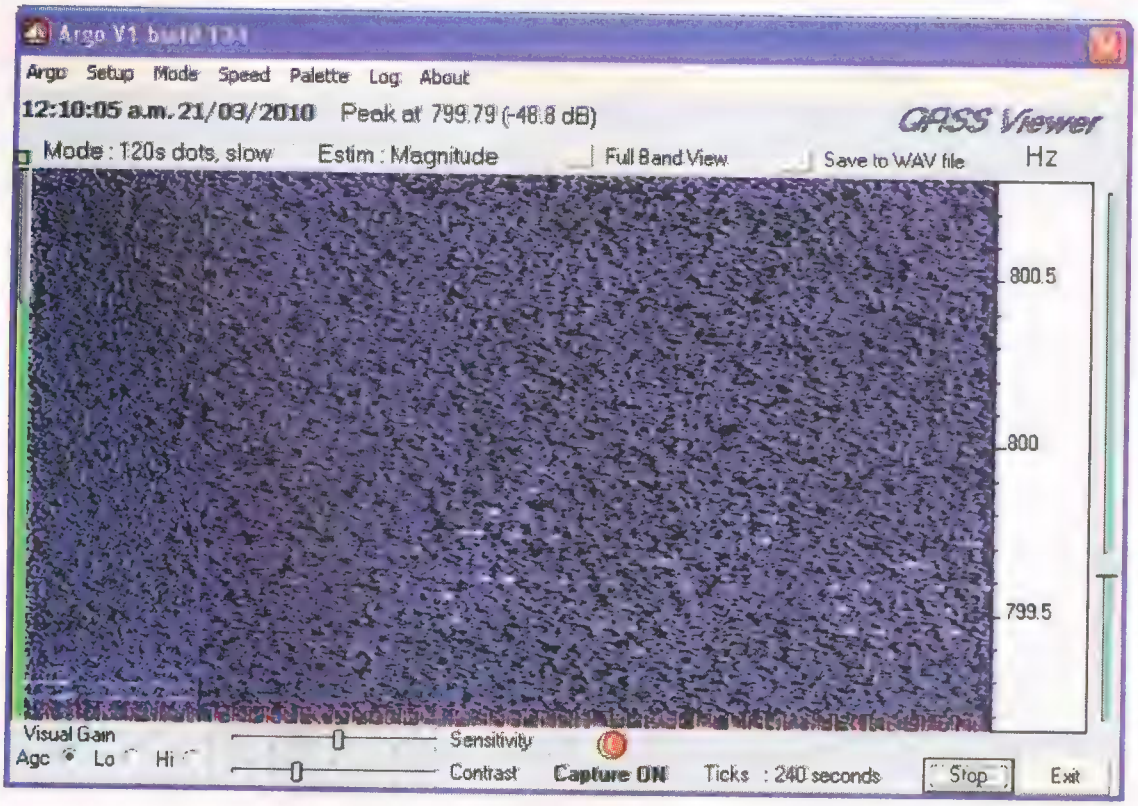

Figure 2: CASTLE mode signal received by ZL2CA of VK1DSH transmission. The estimated EIRP was 25 mW and the distance from VK1DSH to ZL2CA is approximately 2330 km. CASTLE is decoded by observing that individual dots are below the centre frequency of 799.65 Hz and dashes (same length as dots) are above 799.65 Hz; the frequency shift of each signal element is determined by its position within the code group for each character. Thus 'V' is collection of three lines below the centre and one line above. The actual frequency used for the test was 135.920 kHz.